

# PATENT ABSTRACTS OF JAPAN

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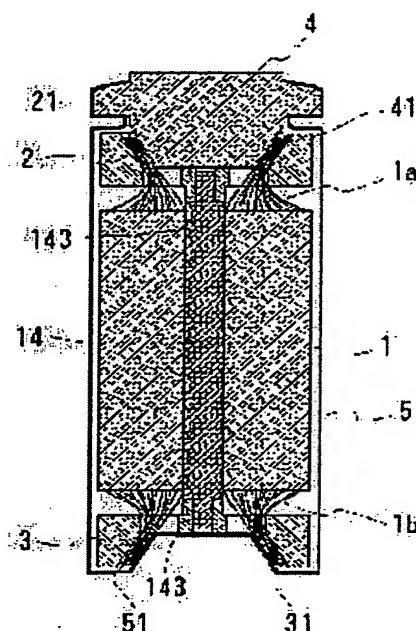
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## (54) BATTERY AND PRODUCING METHOD THEREOF

### (57)Abstract:

**PROBLEM TO BE SOLVED:** To provide a battery and a producing method thereof, capable of easily forming a current collecting structure and simplifying the assembling process.

**SOLUTION:** The battery is provided with positive electrode and negative electrode reed parts 1a and 1b, positive electrode and negative electrode current collecting members 2 and 3 having first taper surfaces 21 and 31, a cap member 4 having a second taper surface 41 opposite to the first taper surface 21, and a battery container 5 having a second tapered surface 51 opposite to the first taper surface 31. The positive electrode reed part 1a is held by the first tapered surface 21 and the second taper surface 41, and the negative electrode reed part 1b is held by the first tapered surface 31 and the second taper surface 51, respectively. This battery can be produced with a step of installing the cap member 4 after accommodating an electrode body 1 wherein the positive electrode current collecting member 2 and the negative electrode current collecting member 3 are attached into the battery container 5, then the battery container 5 and the cap member 4 are fixed, so as to pinch the positive electrode reed part 1a and the negative electrode reed part 1b and to fix the electrode body 1.



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[Claim(s)]

[Claim 1] The cell characterized by to have the current collection lead section formed in the side edge side of an electrode object, current collection flange material with the first taper side which spreads towards the outside or the inside of this electrode object, and a holddown member with the second taper side which counters this first taper side, and for the above-mentioned current collection lead section to be pinched by the above-mentioned first taper side and the above-mentioned second taper side.

[Claim 2] As the above-mentioned current collection lead section is pulled out at the above-mentioned first taper side side, after it is the manufacture approach of a cell according to claim 1, and it arranges the above-mentioned current collection flange material to the side edge side of the above-mentioned electrode object, By holding this electrode object and this current collection flange material in a cell container, laying the above-mentioned holddown member subsequently to above the above-mentioned flange material, and fixing the above-mentioned cell container and the above-mentioned holddown member after that The manufacture approach of the cell characterized by fixing the above-mentioned electrode object while compressing between the above-mentioned first taper side and the above-mentioned second taper sides and pinching the above-mentioned current collection lead section.

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the cell which can simplify a production process, and its manufacture approach by having specific current collection structure. In addition, it is used with a "cell" into this description in the semantics which also contains a capacitor in addition to the so-called cells, such as a nickel hydride battery and a lithium ion battery.

[0002]

[Description of the Prior Art] The cell equipped with the electrode object of the winding mold which comes to wind the separator allotted between a long picture-like positive-electrode lateral electrode sheet and a negative-electrode lateral electrode sheet, and a two-electrodes sheet is known. For example, the field which does not apply an active material is established in the side edge side of a two-electrodes sheet, and the cylindrical rechargeable battery which connects the part to the current collection terminal of each positive-electrode negative electrode as two or more strip-of-paper-like leads (current collection lead section) is indicated by JP,9-92335,A. Moreover, also in the cell equipped with the electrode object of the laminating mold which comes to carry out the laminating of the positive-electrode lateral electrode sheet of two or more sheets, a negative-electrode lateral electrode sheet, and the separator, connecting to a current collection terminal the current collection lead section formed in the side edge side of each electrode sheet is known. Usually, the above-mentioned current collection lead section and a current collection terminal are connected by welding. And after carrying out the welding process of this current collection terminal, the structure which holds an electrode object in a cell container and is fixed to it is common.

[0003]

[Problem(s) to be Solved by the Invention] However, since the process which holds an electrode object in a cell container further, and is fixed is needed once connecting a current collection terminal to the current collection lead section (immobilization) in order to manufacture a cell with the above current collection structures, many routing counters which manufacture of a cell takes are cost high. Moreover, since approaches, such as welding, are used for connection between the current collection lead section and a current collection terminal, improvement and automation of productive efficiency are difficult.

[0004] Formation of current collection structure is easy for the object of this invention, and is to offer the cell which can simplify like an erector, and its manufacture approach.

[0005]

[Means for Solving the Problem] In order to solve the above-mentioned technical problem, a cell according to claim 1 The current collection lead section formed in the side edge side of an electrode object, and current collection flange material with the first taper side which spreads towards the outside or the inside of this electrode object, It has a holddown member with the second taper side which counters this first taper side, and is characterized by the above-mentioned current collection lead section being pinched by the above-mentioned first taper side and the above-mentioned second taper side.

[0006] The cell of this invention As the above-mentioned current collection lead section is pulled out at the above-mentioned first taper side side, after [ according to claim 2 ] it arranges the above-mentioned current collection flange material to the side edge side of the above-mentioned electrode object like, By holding this electrode object and this current collection flange material in a cell container, laying the above-mentioned holddown member subsequently to above the above-mentioned flange material, and fixing the above-mentioned cell container and the above-mentioned holddown member after that While compressing between the above-mentioned first taper side and the above-mentioned second taper sides and pinching the above-mentioned current collection lead section, it can manufacture suitably by the approach of fixing the above-mentioned electrode object.

[0007]

[Embodiment of the Invention] Hereafter, an example explains this invention concretely.

(1) The rechargeable lithium-ion battery of the winding mold which applied whole cell configuration this invention is shown in drawing 1 R> 1. Negative-electrode lead section (current collection lead section) 1b formed in positive-electrode lead section (current collection lead section) 1a by which this cell was formed in the electrode object 1 and the side edge side of the upside in drawing 1 of this electrode object 1, and a lower side edge side, The cap member (holddown member) 4, the electrode object 1 which have been arranged above the positive-electrode current collection member (current collection flange material) 2 arranged at the positive-electrode lead section 1a side of the electrode object 1, the negative-electrode current collection member (current collection flange material) 3 arranged at the negative-electrode lead section 1b side of the electrode object 1, and the positive-electrode current collection member 2 And both the current collection members 2 and 3 are held, and the cap member 4 is equipped with the cell container 5 by which caulking immobilization was carried out.

[0008] Positive-electrode lead section 1a is pinched by the second taper side 41 which the first taper side 21 which the positive-electrode current collection member 2 has, and

the cap member 4 have. closed-end [ as for the cell container 5 / by which the second taper side 51 was formed in the pars basilaris ossis occipitalis on the other hand ] -- negative-electrode lead section 1b is pinched by the second taper side 51 which the first taper side 31 which it is cylindrical and the negative-electrode current collection member 3 has, and the cell container 5 have. That is, this cell container 5 serves as the "holddown member" of a publication to the claim. Every time positive-electrode lead section 1a and negative-electrode lead section 1b are welded with other members, it does not break, but the flow with the exterior is taken by carrying out a pressure welding to the first taper sides 21 and 31 and the second taper sides 41 and 51.

[0009] (2) The cell of manufacture \*\*\*\*\* from opening of the cell container 5 (it serves as a holddown member) with which the second taper side 51 was formed in the base After inserting the electrode object 1 which equipped the vertical side edge side with the positive-electrode current collection member 2 and the negative-electrode current collection member 3 and arranging the cap member 4 subsequently to above the positive-electrode current collection member 2, it can manufacture by closing opening of the cell container 5 etc., applying compressive force between the cap member 4 and a base. Hereafter, it explains in more detail about the manufacture approach of this cell.

[0010] (2-1) As shown in production drawing 2 of an electrode object, the positive-electrode sheet 11 consists of a positive-electrode charge collector 111 of the shape of a long picture which consists of aluminium foil with a thickness of 25 micrometers, and a positive-active-material layer 112 with a thickness of 85 micrometers prepared in both sides of this positive-electrode charge collector 111. The positive-active-material layer 112 is formed by drying and pressing, after applying to both sides of the positive-electrode charge collector 111 a positive-active-material paste (paste which kneaded positive active material, electric conduction-ized material, a binder, etc.) with a comma coating machine or a die coating-machine method. As positive active material, especially if it functions as a lithium cell, it is not limited, for example,  $\text{LiMn}_2\text{O}_4$ ,  $\text{LiCoO}_2$ , and  $\text{LiNiO}_3$  grade can be used. The band-like region in which the positive-active-material layer 112 is not formed is left behind to one long side of the positive-electrode charge collector 111, and positive-electrode current collection lead 1a which consists of aluminium foil with a 100 micrometer[ in thickness ] x width-of-face [ of 10mm ] x die length of 30mm here is welded to it at intervals of 50mm.

[0011] The negative-electrode sheet 12 consists of a negative-electrode charge collector 121 of the shape of a long picture which consists of copper foil with a thickness of 30 micrometers, and a negative-electrode active material layer 122 with a thickness of 80 micrometers prepared in both sides of this negative-electrode charge collector 121. The

formation approach of this negative-electrode active material layer 122 is the same as that of the positive-active-material layer 121. As a negative-electrode active material, especially if it functions as a lithium cell, it is not limited, for example, graphite carbon, amorphous carbon, etc. can be used. The band-like region in which the negative-electrode active material layer 122 is not formed is left behind to one long side of the negative-electrode charge collector 121, and negative-electrode current collection lead 1b which consists of copper foil with a 100 micrometer[ in thickness ] x width-of-face [ of 10mm ] x die length of 30mm here is welded to it at intervals of 50mm.

[0012] A separator 13 consists of porosity polypropylene with a thickness of 25 micrometers. As shown in drawing 2 , these are piled up in order of the positive-electrode sheet 11, a separator 13, the negative-electrode sheet 12, and a separator 13 (a laminating is carried out so that positive-electrode lead section 1a and negative-electrode lead section 1b may become an opposite hand), it winds around the perimeter of a winding core 14, and the electrode object 1 is acquired. the major diameter 141 a little longer than the width of face around which this winding core 14 becomes from resin, such as polyphenyl sulfate, or the metal which prepared insulating layers, such as resin and ceramics, in the front face, and positive-electrode sheet 11 grade is wound, the narrow diameter portion 142 formed in ends, and with [ which it has ] a stage -- it is cylindrical. Between the major diameter 141 and the narrow diameter portion 142, the joggled aspect 143 which stops the positive-electrode current collection member 2 and the negative-electrode current collection member 3 is formed.

[0013] (2-2) As the positive-electrode current collection member 2 made from the wearing aluminum of a current collection member is shown in drawing 3 and drawing 4 , the approximately cylindrical outside annular section 22 and the approximately cylindrical inside annular section 23 make the configuration connected by the cross-joint-like connection section 24. The breakthrough 25 of four fanning is formed between the outside annular section 22 and the inside annular section 23. The first taper side 21 which spreads outside (that is, it spreads on the outside of the electrode object 1) is formed in the inner skin of the outside annular section 22 as it goes to the drawing 4 upside. The negative-electrode current collection member 3 is copper, the configuration is the same as that of the positive-electrode current collection member 2, the outside annular section 32 and the inside annular section 33 are connected by the connection section 34, and four breakthroughs 35 are formed between them. The first taper side 31 which spreads on the outside of the electrode object 1 is formed in the inner skin of the outside annular section 32.

[0014] As shown in drawing 5 , the side by which the first taper sides 21 and 31 were

formed in the upside end face and bottom end face of the electrode object 1, respectively in the positive-electrode current collection member 2 and the negative-electrode current collection member 3 inserts and equips the inside annular sections 22 and 32 with a narrow diameter portion 142 with the sense arranged in the electrode object 1 and an opposite hand. At this time, breakthroughs 25 and 35 pull out positive-electrode lead section 1a and negative-electrode lead section 1b at through, first taper side 21, and 31 side, respectively. The positive-electrode current collection member 2 and the negative-electrode current collection member 3 are stopped by the jogged aspect 143 in which the winding core 14 was formed up and down, respectively. Moreover, omission of the lead section in the middle of the assembly of the positive-electrode current collection member 2 with which it was equipped by what is done a little for the bending deformation of positive-electrode lead section 1a and the negative-electrode lead section 1b (in for example, direction put close to the first taper sides 21 and 31), and the negative-electrode current collection member 3 can also be prevented.

[0015] (2-3) As shown in hold drawing 6 to a cell container, the cell container 5 is a deep-drawing can made from stainless steel, and the second taper side 51 is formed in the base as mentioned above. This second taper side 51 is a configuration corresponding to the first taper side 31 of the negative-electrode current collection member 3, and drawing 6 went caudad and it spreads out. In addition, as construction material of the cell container 5, aluminum besides stainless steel, a galvanized steel sheet, etc. can be used. If the electrode object 1 which equipped with the positive-electrode current collection member 2 and the negative-electrode current collection member 3 in this cell container 5 is inserted, the second taper side 51 and the first taper side 31 which were formed in the base of the cell container 5 will counter on both sides of negative-electrode lead section 1b.

[0016] Here, the electrolytic solution which is not illustrated in the cell container 5 is poured in. As the electrolytic solution, what dissolved one mol [l. ]  $\text{LiPF}_6$  in the mixed solvent of the weight ratio 7:3 of diethyl carbonate (DEC) and ethylene carbonate (EC) can be used, for example.

[0017] (2-4) As shown in the plot plan 7 of a cap member, the cap member 4 has the second taper side 41 formed between the soffit side and the side face, and the flange 42 formed in the upper part and is cylindrical. This cap member 4 is equipped with the shielding rubber with which between the cell containers 5 is insulated, the relief valve (neither is illustrated) which prevents superfluous lifting of cell internal pressure while it seals the building envelope of the cell container 5. The part from the second taper side 41 to outside at least of the cap member 4 consists of conductive ingredients, such as

aluminum, nickel, and noble metals (Ag, Au, Pt), and, thereby, is enabling the flow with the exterior.

[0018] After holding the electrode object 1 equipped with both the current collection members 2 and 3 in the cell container 5, a converging section 52 is formed in the cell container 5 [ above the positive-electrode current collection member 2 ]. Subsequently, the cap member 4 is inserted from opening of the cell container 5, and it stops with a converging section 52. The first taper side 21 and the second taper side 41 counter on both sides of positive-electrode lead section 1a.

[0019] (2-5) Pressing the pinching cap member 4 of the lead section caudad, fix opening of the cell container 5 with the cap member 4 in total, and intercept the interior of a cell, and outer space. As shown in drawing 1 , the cap member 4 is forced on the positive-electrode current collection member 2 by this press, the second taper side 41 and the first taper side 21 are compressed, and positive-electrode lead section 1a is pinched. Moreover, since the positive-electrode current collection member 2 and the negative-electrode current collection member 3 are in contact with the joggled aspect 143, the negative-electrode current collection member 3 is forced on the base of the cell container 5 by the thrust applied to the cap member 4. Thereby, the first taper side 31 and the second taper side 51 are compressed, and negative-electrode lead section 1b is pinched. Moreover, maintenance immobilization of the electrode object 1 is carried out by the compressive force applied between this cap member 4 and the cell container 5.

[0020] According to this manufacture approach, after inserting in order the electrode object 1 which equipped the interior of the cell container 5 with both the current collection members 2 and 3, the electrolytic solution, and the cap member 4, a cell can be assembled by easy actuation of closing opening of the cell container 5. In case opening is closed, it is not necessary to weld in order to form current collection structure and to form this current collection structure by carrying out the pressure welding of positive-electrode lead section 1a and the negative-electrode lead section 1b to the cap member 4 and the cell container 5, respectively. Moreover, connection between positive-electrode lead section 1a and negative-electrode lead section 1b, and the exterior and immobilization of the electrode object 1 in the cell container 5 can be performed at one process by applying compressive force to the shaft orientations of a cell.

[0021] In addition, although the cell container 5 was fixed by the caulking in the above-mentioned example, pressing the cap member 4 caudad, the cell container 5 may be welded to the cap member 4, and you may fix. Moreover, although the positive-electrode current collection member 2 and the negative-electrode current



collection member 3 were stopped to the winding core 14 in the above-mentioned example, it can also consider as the configuration which carries out the screw stop of the positive-electrode current collection member 2 and the negative-electrode current collection member 3 to a winding core 14. Furthermore, although the first taper sides 21 and 31 considered as the configuration which spreads outside in the above-mentioned example as it separated from the electrode object 1, it is good also as the first taper side of the configuration which spreads towards the inside of an electrode object conversely.

[0022]

[Effect of the Invention] The cell of this invention is equipped with the current collection structure where the current collection lead section was pinched, between the first taper side and the second taper side. Since a welding process is not needed for formation of this current collection structure, manufacture effectiveness is well easy also for automation. Moreover, according to the manufacture approach of this invention, pinching of a current collection lead and immobilization of an electrode object can be performed at one process by carrying out sequential insertion of each part material, and finally fixing an electrode container and a holddown member in a cell container. The cell and its manufacture approach of this invention are applicable to both a winding mold cell and a laminating mold cell. When it applies to a winding mold cell, since the effectiveness by having the current collection structure of this invention is often demonstrated, it is desirable.

[Brief Description of the Drawings]

[Drawing 1] It is drawing of longitudinal section showing the cell of this invention.

[Drawing 2] In the manufacture approach of the cell of an example, it is the top view showing the formation process of an electrode object.

[Drawing 3] It is the top view showing the current collection member in the cell of an example.

[Drawing 4] It is the IV-IV line sectional view of drawing 3.

[Drawing 5] In the manufacture approach of the cell of an example, it is drawing of longitudinal section showing the phase which equipped the both-sides end face of an electrode object with the current collection member.

[Drawing 6] In the manufacture approach of the cell of an example, it is drawing of longitudinal section showing the phase which held the electrode object and the current collection member in the cell container.

[Drawing 7] In the manufacture approach of the cell of an example, it is drawing of longitudinal section showing the phase which has arranged the cap member.

[Description of Notations]

An electrode object, the 1a:positive-electrode lead section (current collection lead section), 1b : 1: The negative-electrode lead section (current collection lead section), 14: -- a winding core, a 143:joggled aspect, 2:positive-electrode current collection member (current collection flange material), the 21:first taper side, 3:negative-electrode current collection member (current collection flange material), and 31: -- the first taper side, 4:cap member (holddown member), the 41:second taper side, 5:cell containers (holddown member), and the 51:second taper side.



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## 【特許請求の範囲】

【請求項1】 電極体の側端面に形成された集電リード部と、該電極体の外側または内側に向けて拡がる第一テーパ面をもつ集電フランジ部材と、該第一テーパ面に対向する第二テーパ面をもつ固定部材と、を備え、上記第一テーパ面および上記第二テーパ面により上記集電リード部が挟持されていることを特徴とする電池。

【請求項2】 請求項1記載の電池の製造方法であって、

上記集電リード部が上記第一テーパ面側に引き出されるようにして上記集電フランジ部材を上記電極体の側端面に配置した後、該電極体および該集電フランジ部材を電池容器に収容し、次いで、上記フランジ部材の上方に上記固定部材を載置し、その後、上記電池容器と上記固定部材とを固定することにより、上記第一テーパ面と上記第二テーパ面との間を圧縮して上記集電リード部を挟持するとともに上記電極体を固定することを特徴とする電池の製造方法。

## 【発明の詳細な説明】

## 【0001】

【発明の属する技術分野】 本発明は、特定の集電構造を有することにより製造工程を簡素化することのできる電池、およびその製造方法に関する。なお、本明細書中において「電池」とは、ニッケル水素電池、リチウムイオン電池などのいわゆる電池以外に、キャパシタをも含む意味で使用する。

## 【0002】

【従来の技術】 長尺状の正極側電極シートおよび負極側電極シートと、両電極シートの間に配されるセパレータとを巻回してなる巻回型の電極体を備えた電池が知られている。例えば特開平9-92335号公報には、両電極シートの側端面に活物質を塗布しない領域を設け、その部分を複数の短冊状リード（集電リード部）として正極負極それぞれの集電端子に接続する円筒型二次電池が開示されている。また、複数枚の正極側電極シート、負極側電極シートおよびセパレータを積層してなる積層型の電極体を備えた電池においても、各電極シートの側端面に形成された集電リード部を集電端子に接続することが知られている。通常、上記集電リード部と集電端子とは溶接により接続される。そして、この集電端子の溶接工程を実施した後、電池容器に電極体を収容して固定する構造が一般的である。

## 【0003】

【発明が解決しようとする課題】 しかし、上記のような集電構造をもつ電池を製造するには、いったん集電リード部を集電端子を接続（固定）した後、さらに電極体を電池容器に収容して固定する工程が必要となるため、電池の製造に要する工程数が多くコスト高である。また、集電リード部と集電端子との接続には溶接等の方法を用いているので、生産効率の向上や自動化が困難である。

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【0004】 本発明の目的は、集電構造の形成が容易であり、組立工程を簡素化することのできる電池、およびその製造方法を提供することにある。

## 【0005】

【課題を解決するための手段】 上記課題を解決するために、請求項1記載の電池は、電極体の側端面に形成された集電リード部と、該電極体の外側または内側に向けて拡がる第一テーパ面をもつ集電フランジ部材と、該第一テーパ面に対向する第二テーパ面をもつ固定部材と、を備え、上記第一テーパ面および上記第二テーパ面により上記集電リード部が挟持されていることを特徴とする。

【0006】 本発明の電池は、請求項2記載のように、上記集電リード部が上記第一テーパ面側に引き出されるようにして上記集電フランジ部材を上記電極体の側端面に配置した後、該電極体および該集電フランジ部材を電池容器に収容し、次いで、上記フランジ部材の上方に上記固定部材を載置し、その後、上記電池容器と上記固定部材とを固定することにより、上記第一テーパ面と上記第二テーパ面との間を圧縮して上記集電リード部を挟持するとともに上記電極体を固定する方法によって好適に製造することができる。

## 【0007】

【発明の実施の形態】 以下、実施例により本発明を具体的に説明する。

## (1) 電池の全体構成

本発明を適用した巻回型のリチウムイオン二次電池を図1に示す。この電池は、電極体1、この電極体1の図1における上側の側端面に形成された正極リード部（集電リード部）1aおよび下側の側端面に形成された負極リード部（集電リード部）1b、電極体1の正極リード部1a側に配置された正極集電部材（集電フランジ部材）2、電極体1の負極リード部1b側に配置された負極集電部材（集電フランジ部材）3、正極集電部材2の上方に配置されたキャップ部材（固定部材）4、電極体1および両集電部材2、3を収容しキャップ部材4にかしめ固定された電池容器5、を備える。

【0008】 正極リード部1aは、正極集電部材2のもつ第一テーパ面21およびキャップ部材4のもつ第二テーパ面41により挟持されている。一方、電池容器5は底部に第二テーパ面51が形成された有底円筒状であって、負極集電部材3のもつ第一テーパ面31および電池容器5のもつ第二テーパ面51により負極リード部1bが挟持されている。すなわちこの電池容器5は、特許請求の範囲に記載の「固定部材」を兼ねている。正極リード部1aおよび負極リード部1bは、他の部材と溶接されてはならず、第一テーパ面21、31および第二テーパ面41、51に圧接されることによって外部との導通がとられている。

## 【0009】 (2) 製造方法

この電池は、底面に第二テーパ面51の形成された電池

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容器5（固定部材を兼ねる）の開口部から、正極集電部材2および負極集電部材3を上下側端面に装着した電極体1を挿入し、次いで正極集電部材2の上方にキャップ部材4を配置した後、キャップ部材4と底面との間に圧縮力を加えつつ電池容器5の開口部をかしめる等の方法により製造することができる。以下、この電池の製造方法についてさらに詳しく説明する。

#### 【0010】（2-1）電極体の作製

図2に示すように、正極シート11は、例えば厚さ25μmのアルミニウム箔からなる長尺状の正極集電体111と、この正極集電体111の両面に設けられた厚さ85μmの正極活物質層112とからなる。正極活物質層112は、コンマコーターまたはダイコーター方式により正極集電体111の両面に正極活物質ペースト（正極活物質、導電化材、バインダ等を混練したペースト）を塗布した後、乾燥、プレスすることにより形成される。正極活物質としては、リチウム電池として機能するものであれば特に限定されず、例えば $\text{LiMn}_2\text{O}_4$ 、 $\text{LiCoO}_2$ 、 $\text{LiNiO}_3$ 等を用いることができる。正極集電体111の一方の長辺には、正極活物質層112の形成されない帯状域が残されており、ここに厚さ100μm×幅10mm×長さ30mmのアルミニウム箔からなる正極集電リード1aが50mm間隔で溶接されている。

【0011】負極シート12は、例えば厚さ30μmの銅箔からなる長尺状の負極集電体121と、この負極集電体121の両面に設けられた厚さ80μmの負極活物質層122とからなる。この負極活物質層122の形成方法は正極活物質層121と同様である。負極活物質としては、リチウム電池として機能するものであれば特に限定されず、例えばグラファイトカーボン、アモルファスカーボン等を用いることができる。負極集電体121の一方の長辺には、負極活物質層122の形成されない帯状域が残されており、ここに厚さ100μm×幅10mm×長さ30mmの銅箔からなる負極集電リード1bが50mm間隔で溶接されている。

【0012】セパレータ13は、例えば厚さ25μmの多孔質ポリプロピレンからなる。図2に示すように、これらを正極シート11、セパレータ13、負極シート12、セパレータ13の順に重ね（正極リード部1aと負極リード部1bとが反対側となるように積層する）、巻芯14の周囲に巻回して電極体1を得る。この巻芯14は、ポリフェニルサルフェート等の樹脂、または表面に樹脂、セラミックス等の絶縁層を設けた金属からなり、正極シート11等が巻回される幅よりもやや長い大径部141と、両端に形成された小径部142とを有する段付円柱状である。大径部141と小径部142との間には、正極集電部材2および負極集電部材3を係止する段付面143が形成されている。

#### 【0013】（2-2）集電部材の装着

アルミニウム製の正極集電部材2は、図3および図4に

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示すように、略円筒状の外側環状部22と内側環状部23とが、十字状の連結部24によって繋がれた形状をなす。外側環状部22と内側環状部23との間には、4つの扇型の貫通孔25が形成されている。外側環状部22の内周面には、図4の上側に向かうにつれて外側に拡がる（すなわち、電極体1の外側に拡がる）第一テーパ面21が形成されている。負極集電部材3は銅製であり、その形状は正極集電部材2と同一であって、外側環状部32と内側環状部33が連結部34によって繋がれ、その間に4つの貫通孔35が形成されている。外側環状部32の内周面には、電極体1の外側に拡がる第一テーパ面31が形成されている。

【0014】図5に示すように、電極体1の上側端面および下側端面に正極集電部材2および負極集電部材3を、それぞれ第一テーパ面21、31の形成された側が電極体1と反対側に配置される向きで、内側環状部22、32に小径部142を挿入して装着する。このとき、正極リード部1aおよび負極リード部1bをそれぞれ貫通孔25、35に通し、第一テーパ面21、31側に引き出されるようにする。正極集電部材2および負極集電部材3は、巻芯14の上下に形成された段付面143にそれぞれ係止される。また、正極リード部1aおよび負極リード部1bをやや曲げ変形させておく（例えば、第一テーパ面21、31に近づける方向に）ことにより、装着された正極集電部材2および負極集電部材3の組立途中におけるリード部の脱落を予防することもできる。

#### 【0015】（2-3）電池容器への収容

図6に示すように、電池容器5はステンレス製の深絞り缶であって、その底面には前述のように第二テーパ面51が形成されている。この第二テーパ面51は、負極集電部材3の第一テーパ面31に対応した形状であって、図6の下方向に向かって拡がっている。なお、電池容器5の材質としては、ステンレスの他、アルミニウム、メッキ鋼板等を用いることができる。この電池容器5内に、正極集電部材2および負極集電部材3を装着した電極体1を挿入すると、電池容器5の底面に形成された第二テーパ面51と第一テーパ面31とが負極リード部1bを挟んで対向する。

【0016】ここで、電池容器5内に図示しない電解液を注入する。電解液としては、例えばジエチルカーボネート（DEC）とエチレンカーボネート（EC）との重量比7：3の混合溶媒に、1mol／リットルの $\text{LiPF}_6$ を溶解させたものを用いることができる。

#### 【0017】（2-4）キャップ部材の配置

図7に示すように、キャップ部材4は、下端面と側面との間に形成された第二テーパ面41と、その上方に形成された鐮部42とを有する円柱状である。このキャップ部材4は、電池容器5の内部空間を密閉するとともに電池容器5との間を絶縁するシールドゴム、電池内圧の過

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剥な上昇を防止する安全弁（いずれも図示せず）等を備える。キャップ部材4の少なくとも第二テーパ面41から外部に至る部分はアルミニウム、ニッケル、貴金属（Ag、Au、Pt）等の導電性材料からなり、これにより外部との導通を可能としている。

【0018】両集電部材2、3を装着した電極体1を電池容器5に収容した後、正極集電部材2の上方において電池容器5に絞り部52を設ける。次いで、電池容器5の開口部からキャップ部材4を挿入して絞り部52にて係止する。第一テーパ面21と第二テーパ面41とは正極リード部1aを挟んで対向する。

【0019】（2-5）リード部の挟持

キャップ部材4を下方に押圧しつつ、電池容器5の開口部をかしめてキャップ部材4と固定し、電池内部と外部空間とを遮断する。この押圧により、図1に示すように、キャップ部材4が正極集電部材2に押しつけられ、第二テーパ面41と第一テーパ面21とが圧縮されて正極リード部1aが挟持される。また、正極集電部材2および負極集電部材3は段付面143と当接しているので、キャップ部材4に加えられた押圧力により負極集電部材3が電池容器5の底面に押しつけられる。これにより、第一テーパ面31と第二テーパ面51とが圧縮されて負極リード部1bが挟持される。また、このキャップ部材4と電池容器5との間にかかる圧縮力によって電極体1が保持固定される。

【0020】この製造方法によると、電池容器5の内部に、両集電部材2、3を装着した電極体1、電解液、およびキャップ部材4を順に挿入した後、電池容器5の開口部をかしめるという簡単な操作により電池を組み立てることができる。開口部をかしめる際、正極リード部1aおよび負極リード部1bがキャップ部材4および電池容器5にそれぞれ圧接されることにより集電構造が形成され、この集電構造を形成するために溶接を行う必要はない。また、電池の軸方向に圧縮力を加えることにより、正極リード部1aおよび負極リード部1bと外部との接続と、電池容器5内における電極体1の固定とを一つの工程で行うことができる。

【0021】なお、上記実施例では電池容器5をかしめにより固定したが、キャップ部材4を下方に押圧しつつ電池容器5をキャップ部材4に溶接して固定してもよい。また、上記実施例では正極集電部材2および負極集電部材3を巻芯14に係止したが、正極集電部材2およ

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び負極集電部材3を巻芯14にネジ止めする構成とすることもできる。さらに、上記実施例では電極体1から離れるに従って第一テーパ面21、31が外側に拡がる形状としたが、逆に電極体の内側に向けて拡がる形状の第一テーパ面としてもよい。

【0022】

【発明の効果】本発明の電池は、第一テーパ面と第二テーパ面との間に集電リード部が挟持された集電構造を備える。この集電構造の形成には溶接工程を必要としないので、製造効率がよく自動化も容易である。また、本発明の製造方法によると、電池容器内に各部材を順次挿入し、最後に電極容器と固定部材とを固定することにより、集電リードの挟持と電極体の固定とを一工程で行うことができる。本発明の電池およびその製造方法は、巻回型電池および積層型電池のいずれにも適用することができる。巻回型電池に適用した場合には、本発明の集電構造を備えることによる効果がよく発揮されるため好ましい。

【図面の簡単な説明】

【図1】本発明の電池を示す縦断面図である。

【図2】実施例の電池の製造方法において、電極体の形成工程を示す平面図である。

【図3】実施例の電池における集電部材を示す平面図である。

【図4】図3のIV-IV線断面図である。

【図5】実施例の電池の製造方法において、電極体の両側端面に集電部材を装着した段階を示す縦断面図である。

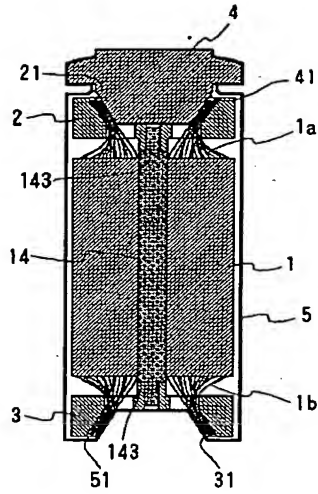
【図6】実施例の電池の製造方法において、電極体および集電部材を電池容器に収容した段階を示す縦断面図である。

【図7】実施例の電池の製造方法において、キャップ部材を配置した段階を示す縦断面図である。

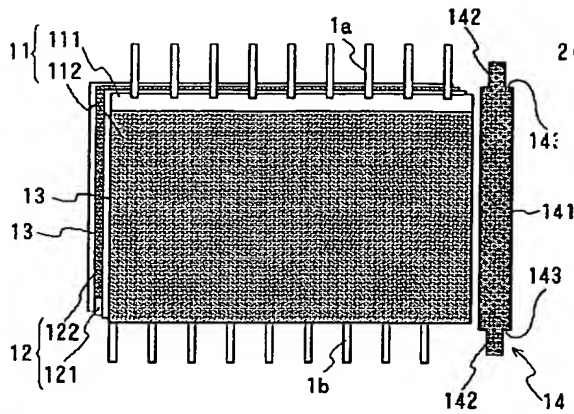
【符号の説明】

1：電極体、1a：正極リード部（集電リード部）、1b：負極リード部（集電リード部）、14：巻芯、143：段付面、2：正極集電部材（集電フランジ部材）、21：第一テーパ面、3：負極集電部材（集電フランジ部材）、31：第一テーパ面、4：キャップ部材（固定部材）、41：第二テーパ面、5：電池容器（固定部材）、51：第二テーパ面。

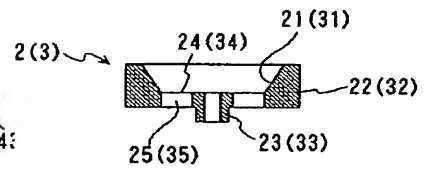
【図1】



【図2】

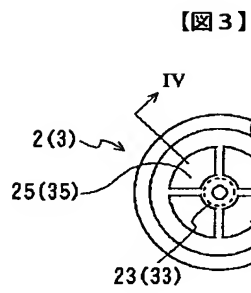


【図4】



【図5】

【図6】



【図7】

